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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,830	01/31/2002	Qin Liu	10014405-1	2306

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EXAMINER	
YUAN, DAH WEI D	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/061,830	LIU ET AL.	
	Examiner	Art Unit	
	Dah-Wei D. Yuan	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 February 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20 and 82-89* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20 and 82-89* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 March 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *02172004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

FUEL CELL WITH FUEL DROPLET FUEL SUPPLY

Examiner: Yuan S.N. 10/061,830 Art Unit: 1745 March 25, 2004

Detailed Action

1. The Applicant's amendment filed on February 17, 2004 was received. Claims 10,18,19,21-81 were cancelled. Claims 1-9,14-17,20 were amended. Claims 82-89 were added.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action issued on December 18, 2003.

Specification

3. The amendment filed on February 17, 2004 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: a fuel supply path extending in a direction that is non-perpendicular to the anode plane in claim 82; the fuel supply path is substantially parallel to the anode plane in claim 83.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 82-89 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The limitations "a fuel supply path extending in a direction that is non-perpendicular to the anode plane" in claim 82 and "the fuel supply path is substantially parallel to the anode plane" in claim 83 are not supported in the specification. If applicant believes said limitations are fully defined, it is requested that applicant indicates column and line, and/or figure with number, in the instant disclosure.

Claim Rejections - 35 USC § 102

6. Claims 1-3,7,8,11-15,17,20 are rejected under 35 U.S.C. 102(e) as being anticipated by Kindler et al. (US 6,440,594 B1).

With respect to claims 1,3,8,11,14, Kindler et al. teach a direct oxidation fuel cell system comprising a plurality of anodes, a plurality of cathodes, a plurality of electrolyte and a fuel reservoir. The fuel is provided in the form of an aerosol of liquid fuel droplets suspended in a gas. The aerosol is formed in a single aerosol generator situated within the anode chamber of the fuel cell. Figure 6 is a schematic representation of a preferred fuel cell system incorporating a stack of individual membrane electrode assemblies and a flow field element having an integral aerosol generator (a single fuel supply apparatus). Alternatively, the pump (20) can be considered as the single fuel supply apparatus. Furthermore, the anode pair is interpreted as the series of anodes above the anode bipolar plate (602) as shown in Figure 6, wherein fuel is

distributed between at least one anode pair. See Abstract; Column 1, Line 64 to Column 2, Line 11; Column 3, Lines 29-34; Column 5, Lines 27-47; Figure 6.

With respect to claim 2,13,17,20 the amount of aerosol fuel delivered to the anode depends upon the particular oxidation catalyst used in the anode, the permeability of the membrane in the electrode assembly to liquid fuel, the fuel concentration in the aerosol droplets, and the temperature and pressure within the cell. By monitoring fuel cell operating characteristics it is possible to determine an optimum aerosol feed rate for a give fuel cell configuration and cell operating conditions. For example, monitoring fuel cell power output, cell potential, or operating current provides convenient measures of fuel cell operating performance suitable for use in controlling the rate of aerosol fuel delivery to the anode. Preferably, the fuel droplet delivery rate is controlled by varying the duty cycle of the aerosol generator to maintain a desired cell output potential at a given power output. See Column 7, Lines 31-67. Kindler et al. do not specifically disclose the presence of a controller in the fuel cell system. However, it is the position of the examiner that such controller is inherent, given that both Kindler et al. and the present application utilize similar operation procedure and control sequence to operate the direct oxidation fuel cell system. Also, a controller would be essential to monitor and regulate the fuel droplet delivery rate into the fuel passage. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature *is necessarily present in that which is described in the reference.* In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 7,12,15, Kindler et al. further teach any number of means for forming an aerosol may be employed. For example, an aerosol may be formed by heat the fuel

to a temperature above its boiling point in the presence of the suspending gas, then rapidly cooling the superheated fuel vapor to nucleate condensed droplets of liquid fuel suspended in the gas. The aerosol is preferably formed by atomizing the liquid fuel into the suspending gas. A wide variety of atomization means are known to those skilled in the art and may be employed in this invention. These include orifices, single fluid atomization nozzles (airless sprayers), two fluid atomization nozzles (gas-assisted sprayers), rotating discs or wheels onto which the liquid is fed, or ultrasonic nozzles in which liquid is feed onto a needle or orifice oscillated at very high frequency to form liquid droplets in a suspending gas. See Column 7, Lines 14-30.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kindler et al. (US 6,440,594 B1).

Kindler et al. disclose a fuel cell system comprising an ultrasonic atomizer as the fuel supply apparatus as described above in Paragraph 3. However, Kindler et al. do not specifically disclose the use a thermal drop ejector, a piezoelectric drop ejector, or a flextensional drop ejector to produce the fuel droplets into the fuel passage. However, ultrasonic atomizer, thermal drop ejector, piezoelectric drop ejector, and flextensional drop ejector are considered

functionally equivalent fuel supply apparatus. See instant specification page 4, lines 8-17; page 10, line 25 to page 11, line 9. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a thermal drop ejector (or a piezoelectric drop ejector, or a flextensional drop ejector) for the ultrasonic atomizer as the fuel droplet generating means in the fuel cell system disclosed by Kindler.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kindler et al. as applied to claims 1-3,7,8,10-20 above, and further in view of Singh et al. (US 6,572,993 B2).

Kindler et al. disclose a fuel cell system as described above in Paragraph 3. However, Kindler et al. do not disclose that the fuel cell system further comprising storage means for storing energy generated by the system. Singh et al. teach an electrical storage device is coupled in parallel to a fuel cell power generation system. The electrical storage device is either a battery pack, a plurality of capacitors, or a plurality of supercapacitors. The electrical storage device is capable of minimizing the unreacted fuel within the anode chamber. See Abstract, Column 1, Lines 40-64; Column 2, Lines 3-29. Therefore, it would have been obvious to one of ordinary skill in the art to coupled an electrical storage device to the fuel cell system of Kindler et al. in parallel, because Singh et al. teach the use of either a battery pack, capacitors or supercapacitors to reduce the amount of excess fuel during transient operating conditions.

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kindler et al. (US 6,440,594 B1) in view of Pun (US 6,152,382).

Kindler et al. disclose a method of operating a fuel cell as described above in Paragraph 6. However, Kindler et al. do not disclose the use of a fan in blowing the droplets towards the anode. Pun teaches that fans and blowers are required to project the atomized droplets to intended targets. See Column 1, Lines 22-25. Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a fan on the method of operating a fuel cell of Kindler et al., because Pun teaches the use of a fan to help project the atomized droplets to the intended targets (anode plates) in the fuel cell system.

Response to Arguments

11. Applicant's arguments filed on February 17, 2004 have been fully considered but they are not persuasive.

Applicant's principle arguments are

(a) Kindler reference does not teach or suggest a single fuel supply apparatus that supplies a plurality of fuel droplets to the anodes;

(b) there is no evidence to indicate that thermal, piezoelectric and flextensional drop ejectors are functionally equivalent to an ultrasonic atomizer;

(c) Kindler reference fails to teach or suggest a fuel stack with anodes that face one another with a fuel passage therebetween;

(d) amended independent claim 16 directs to a combination of method steps the blowing the droplets towards the anode with a fan;

(e) amended independent claim 20 calls for a fuel cell system in which fuel droplets are supplied at a rate that results in f fuel layer being maintained on the anode.

In response to Applicant's arguments, please consider the following comments.

(a) Kindler et al. teach the use of a single aerosol generator to supply the fuel droplets to the anodes in the fuel cell stack. The generator is composed of a plurality of nozzles. See Column 15, Line 66 to Column 16, Line 14; Figure 6;

(b) as admitted in the instant disclosure, the ultrasonic atomizers may be used in place of thermal drop ejectors. Also, ultrasonic atomizer and flextensional drop ejectors are shown in different embodiments in the specification as means to generate fuel droplets to the anodes. See instant specification page 4, lines 8-17; page 10, line 25 to page 11, line 9. Therefore, ultrasonic atomizer, thermal drop ejector, piezoelectric drop ejector, and flextensional drop ejector are considered functionally equivalent fuel supply apparatus;

(c) Kindler reference teaches a series of anode chambers (616) between the anode structure. The fuel is atomized before entering a plurality of anode chambers. See Figure 6; Column 15, Line 66 to Column 16, Line 10.

(d) Pun (US 6,152,382) teaches that fans and blowers are required to project the atomized droplets to intended targets. See Column 1, Lines 22-25. Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a fan on the method of operating a fuel cell of Kindler et al., because Pun teaches the use of a fan to help project the atomized droplets to the intended targets (anode plates) in the fuel cell system.

(f) Kindler et al. teach coalescence of fuel droplets may result from interception of the flowing gas, inertial deviations of the droplets from their desired flow trajectories, or Brownian motion for extremely fine droplets. In addition, suspended liquid fuel droplets may collide with each other and coalesce after leaving the aerosol generator if the number of aerosol droplets is too high. See Column 8, Lines 30-48. It leads to the conclusion that a fuel layer can be formed on the anode after the fuel droplets collide and coalesce.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (571) 272-1295. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Dah-Wei D. Yuan
March 25, 2004